Executing Successful Partnerships with NASA - International Partners' Perspectives

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Feb. 9, 2010

@NASA PM Challenge 2010

JAXA Organization and Resources

As of April 2009

Total Personnel
1670

President

Executive Directors

Annual Budget
199 B yen (2 B US$)

Policy Coordination | **Admin. Management** | **Technical Management**

Space Transportation Mission Directorate

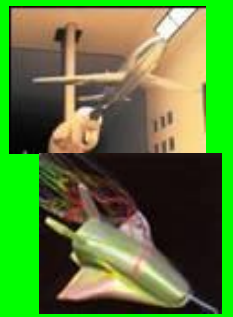
Space Applications Mission

Inst. of Space & Astro. Science

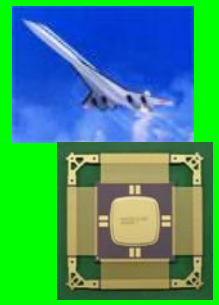
Lunar & Planetary Exploration

Human Space Systems and Utilization Mission Directorate

Aviation Program Group



Aerospace R&D Directorate



Contribution to Realization of "Safe and Secure Society"

- Environment Observation
- Disaster Monitoring
- Satellite Navigation & Communication

Challenge to Unknown Frontier

- Space Science
- Lunar and Planetary Exploration
- International Space Station

Research & Development

- Independent Ability for Space Activity
- Contribution to Aerospace Industry

Outline of the 2nd Mid-term Plan (2008-2013)

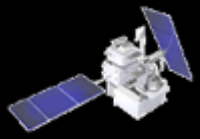
Two major areas of activities in the 2nd Mid-term Plan

- Contribution toward a secure and prosperous society
  - to place a special emphasis on
    (1) Global environment observation
    (2) Disaster monitoring and communication
    (3) Navigation by satellites
- Expansion of human frontiers
  - to utilize Kibo (Japanese Experiment Module) of ISS as a new platform for space activities of Japan and other countries;
  - to promote space science program with a special emphasis on the fields which Japan possesses advantage;
  - to formulate a Moon and planetary exploration program for the future

Project Overview of the 2nd Mid-term Plan

Contributions toward a Secure and Prosperous Society (R&D)

Environment



Precipitation

Global Precipitation Measurement Satellite/ Dual-frequency Precipitation Radar (GPM/DPR)

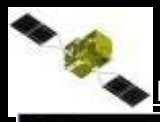
Greenhouse effect gases

Greenhouse Gases Observing Satellite （GOSAT）

Moisture

Global Change Observation Mission-Water（GCOM-W）

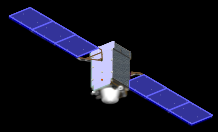
Global Change Observation Mission-Climate（GCOM-C）



Cloud/Aerosol

Cloud Aerosol Radiation Mission/Cloud Profiling Radar (EarthCARE/CPR)

Navigation Satellite



1st Quasi-Zenith Satellite

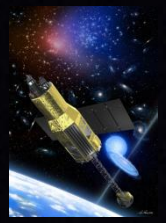
GPS
Availability enhancement
・ Performance enhancement

Expansion of Human Frontiers

International Space Station（ISS）

ISS/Japanese Experiment Module Kibo

H-Ⅱ Transfer Vehicle（HTV）



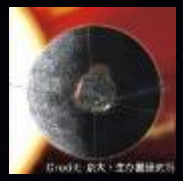
X-ray Astronomy Satellite（ASTRO-H）

Space Science

Radio Astronomy Satellite（ASTRO-G）

Venus Climate Orbiter（PLANET-C）

Space Explorer



Int'l Mercury Exploration Project（BepiColombo）

Successor of SELenological and

Exp

Successor of Asteroid Explorer (HAYABUSA)

Development of Advanced Technologies

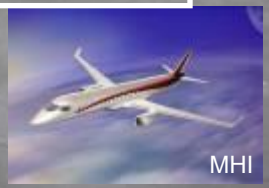
Space Transportation

H-ⅡB launch vehicle

LNG Propulsion System (GX Rocket)

Advanced Solid Rocket

Aeronautics



To Contribute toward industry needs using fundamental tech

Next Generation SST

International Cooperation with USA

- International cooperation between the United States and Japan started in 1969, when "The Japan-U.S. Joint Communiqué" on cooperation in space development was signed.
- Since then, JAXA has been participating in international projects, many of which are led by NASA. This includes the International Space Station as well as Earth Science, and Space Science missions.

Current Cooperative Projects with NASA

1. **ISS Cooperation**
   - Japanese Experiment Module “KIBO” and HTV/H2-B
   - ISS Development, Operation and Utilization

2. **Space Exploration Cooperation (exploring future opportunities)**
   - International Space Exploration Coordination Group (ISECG)

3. **Earth Science Cooperation**
   - Aqua (AMSR-E), TRMM, DAICHI(ALOS), IBUKI (GOSAT), GPM , GCOM
   - Decadal Survey Missions & GEOSS (exploring future opportunities)

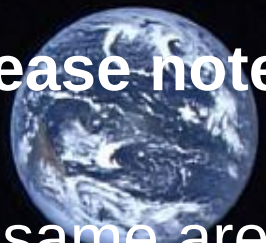
4. **Space Science Cooperation**
   - Fermi, HINODE, SWIFT, NOZOMI, ASCA, ASTRO-H, KAGUYA, SUZAKU, HAYABUSA, HALCA, GEOTAIL
   - Astrophysics & Planetary Science & Heliophysics

Cooperation Levels:

- Level 0: Information & Data Exchange (Earth & Space Science)
- Level 1: Payload Provision (Earth & Space Science)
- Level 2: Joint HW Development (TRMM,GPM, etc.)
- Level 3: Joint Program (ISS)

Maintaining a close partnership with NASA has become indispensable for JAXA

- Almost all JAXA programs and projects involve some level of cooperation with NASA.
- JAXA uses almost identical development process and technical standards with NASA.



Please note that:

- JAXA covers almost same areas of activities as NASA does but with 1/10th the amount of resources (in terms of budget and JAXA staff).
- When NASA makes changes to its programs, the changes can impact JAXA – quickly and severely!

Lessons Learned (Things that should be done)

- Enthusiasm and tolerance are the key traits to emphasize when one seeks to engage partners and to sustain a partnership.
- Common goals and objectives need to be identified and shared among the partners to align their efforts.
- Cooperation must be based on mutual benefits.
- The best leaders are those who lead in a benevolent and reassuring fashion that supports partners' goals.
- An effective partnership is one that emphasizes:
  - Mutual respect & trust - personal relationships are key
  - Commitment to meet responsibilities and to the success of the joint project
- High level political endorsement is required to initiate large scale cooperation programs (e.g. future exploration initiatives).
- Public support is the key to sustaining large scale cooperation program (e.g. ISS and future exploration initiatives).

Lessons Learned (Things to avoid)

- Keep overall program goals (including those of your partners) in mind – not just NASA's goals.
- Don't try to do everything alone. Consider involving close partners in 'critical path' roles (e.g. JAXA's provision of the HTV for the Space Station).
- Avoid making unilateral decisions – try first to indicate a common path and build a consensus.
- Listen to the suggestions of your partners – once in a while you may learn something!
- In managing joint projects, don't be 'exclusive' – try to be 'inclusive' whenever you can.

Conclusion

As the world's largest and most successful space agency, NASA inspires and frequently leads space exploration and space applications programs throughout the world.

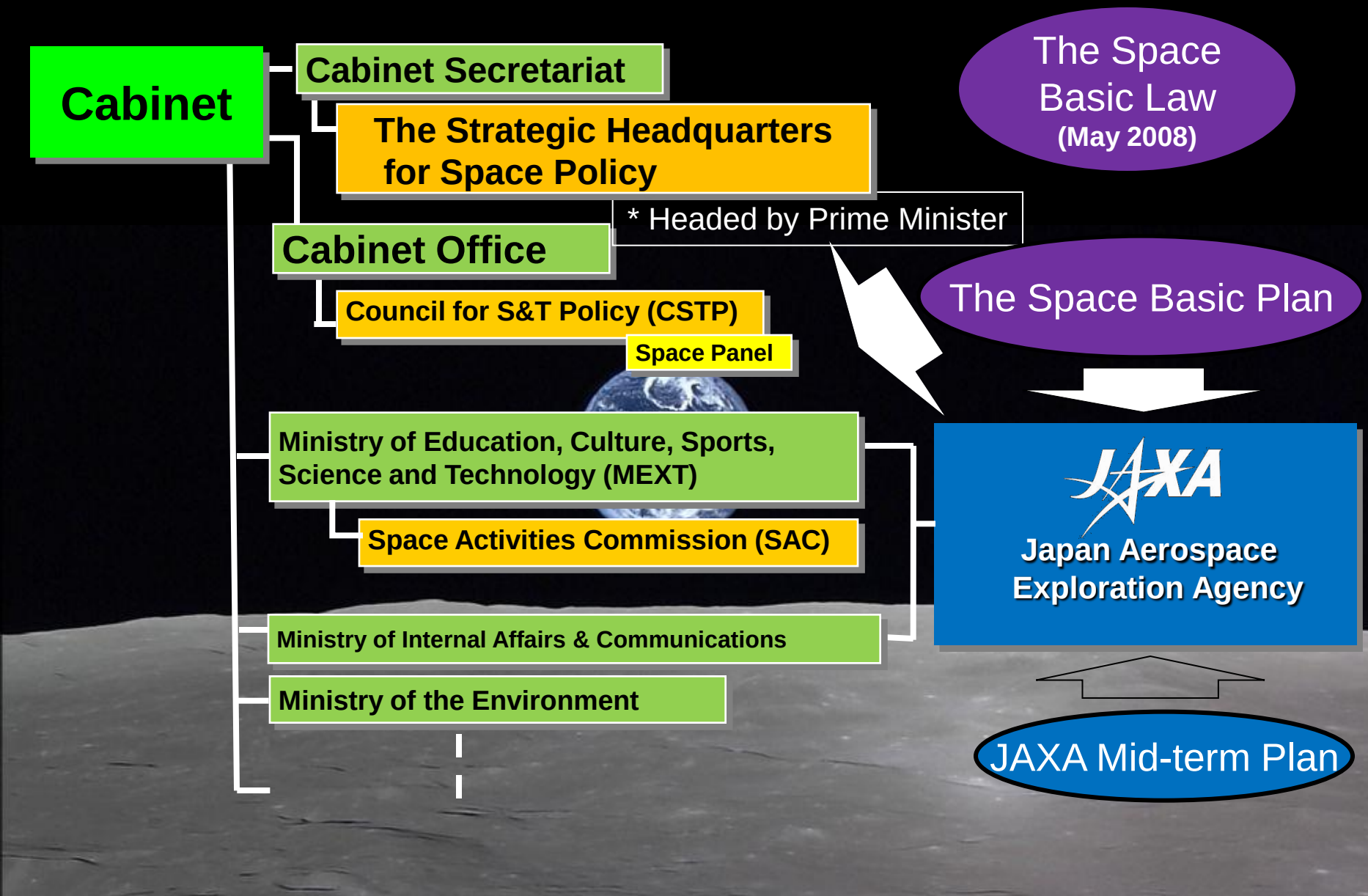
*"You can always count on Americans to **do the right thing**, after they've tried everything else."*

– Sir Winston Churchill

I hope you do always the right thing… but without doing everything else!

Backup Charts

Space Strategy and Organizations



Basic Space Law of Japan

- Japan's Space Basic Law was enacted on 26 May, 2008. Pillars of the Law are Diplomacy on Space, Industrial Development, and Security
- Secretariat of Strategic Headquarters for Space Development was established on 26 August, 2008. set up in the Cabinet Secretariat as the governmental space development management office.
- Space Basic Plan will be established in May 2009 approved by the Prime Minister.
- Review and modify the HQs for Space Policy, JAXA, and SAC within the next year

Outline of Basic Space Law

✓ **Peaceful Use of Space**

Promotion of Space Development and Utilization in line with international agreements for space activities.

(i.e. Space Development and Utilization shall be carried out pursuant to the treaties and other international agreements on space development and utilization in accordance with the idea of pacifist principles in the Constitution of Japan.)

✓ **Improvement of Citizens' Lives, etc.**

Utilization of Satellites contributing to Improvement of Citizens' Lives, National Security, etc.

✓ **Promotion of Industries**

Ensuring Autonomous Launch Capability Satellites, etc.

Promotion of Private Businesses on Space Development and Utilization

Maintenance and Improvement of Reliability of Technologies on Space Development and Utilization

✓ **Development of Human Society**

Promotion of Space Science to contribute to realizing dreams of, and the betterment of lives for, humankind.

✓ **Promotion of International Cooperation, etc.**

Promotion of International Cooptation for contributing to enhancing Japan's role in the international society and to the furtherance of Japan's interests.

✓ **Consideration of Environment Preservation**

Promotion of Space development in harmony with the Environment, and Ensuring International Cooperation on preservation of the Environment.

JAXA Field Centers

Reason Offices

- Washington, DC, USA
- Huston, TX, USA
- Paris, France
- Bangkok, Thailand

Noshiro Testing Ctr.

Kakuda Space Ctr.

Tsukuba Space Center

Earth Observation Ctr.

Usuda Deep Space Ctr.

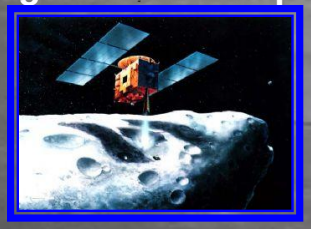
JAXA Tokyo Office

Katsuura T & C Stn.

Kagoshima Space Center

Aerospace Research Ctr.

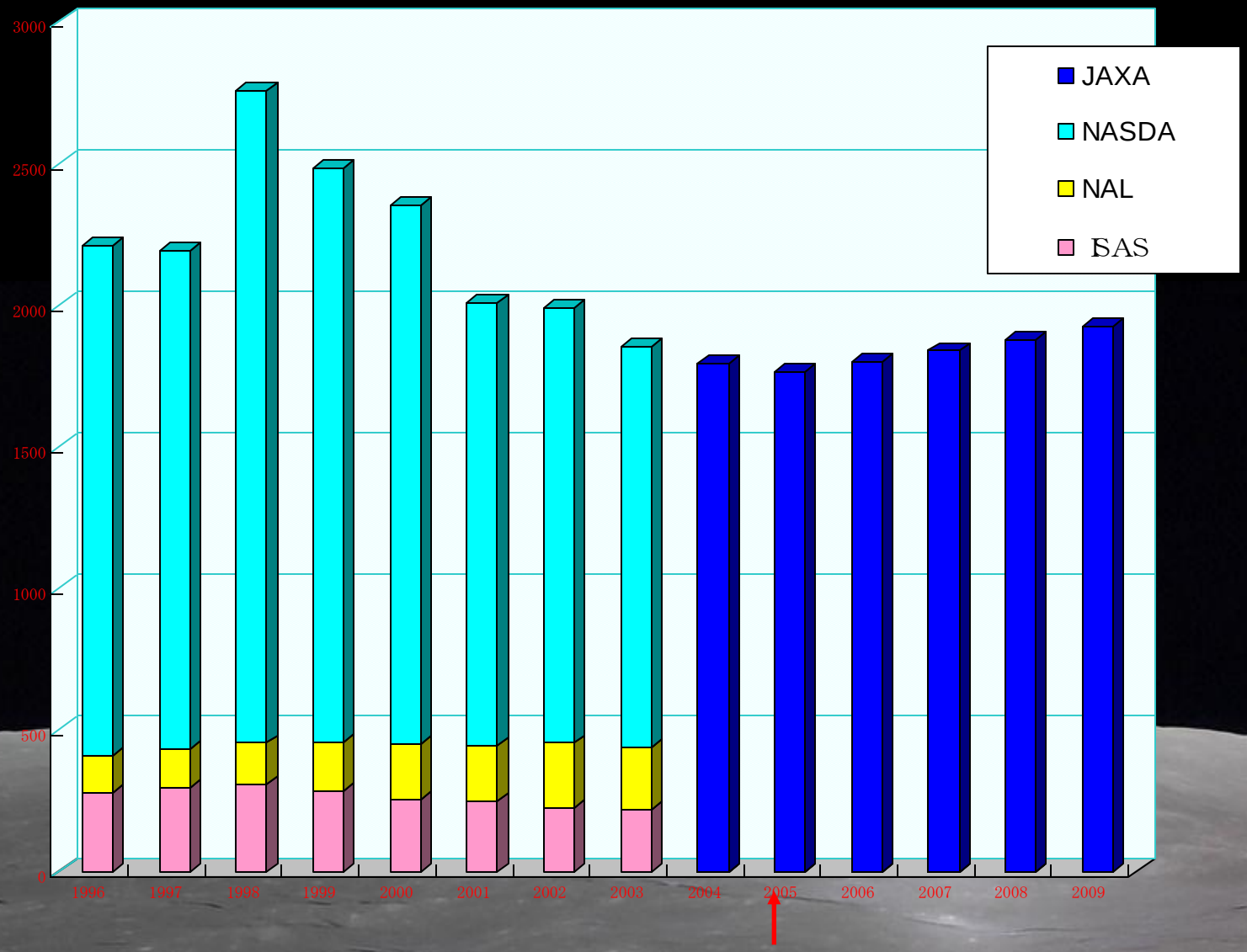
Sagamihara Campus



Okinawa T & C Stn.

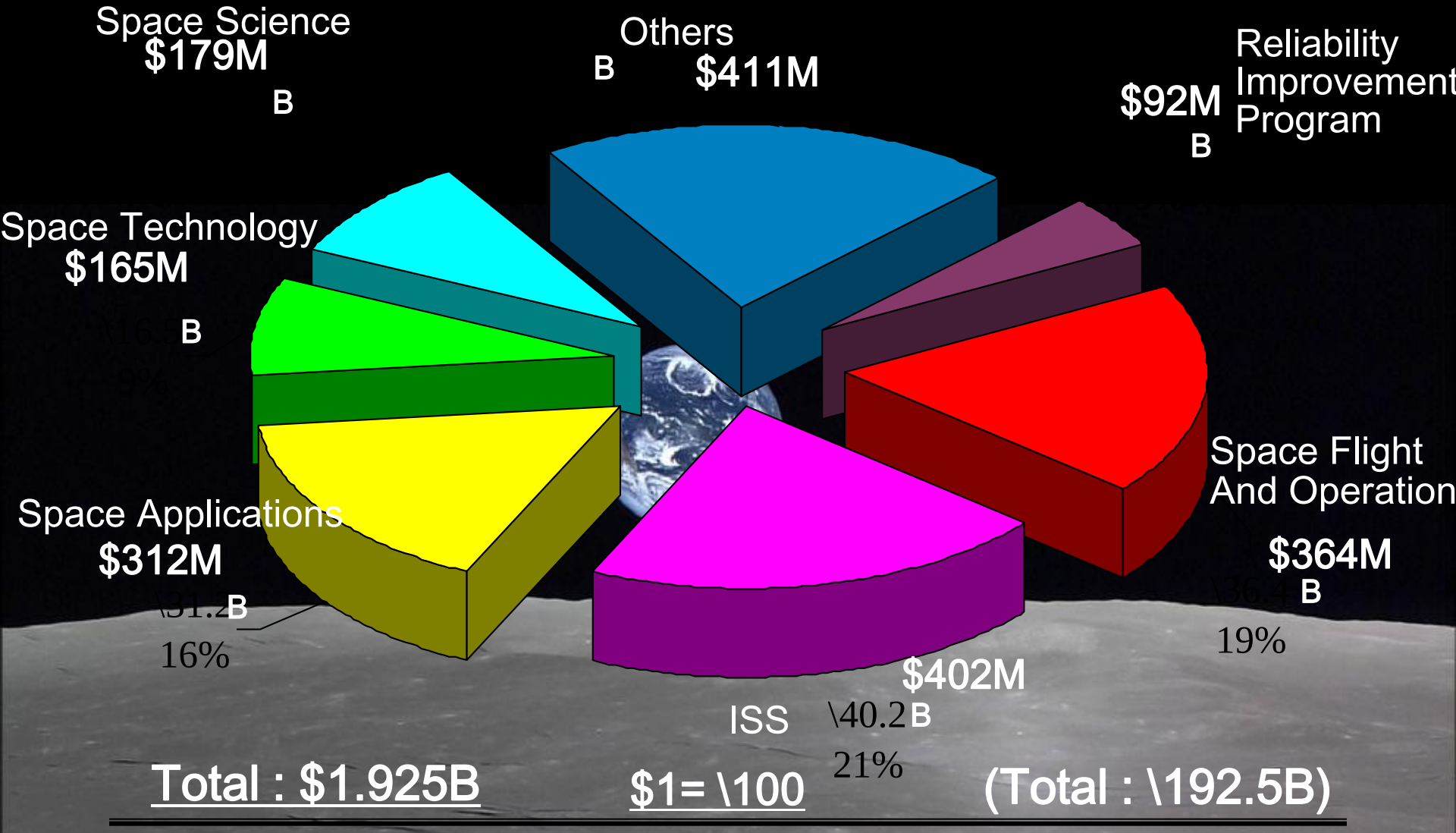
Ogasawara Downrange Stn.

JAXA Budget Trend



JAXA Budget for FY 2009

Ratio for each field of program in JAXA Budget from GOJ

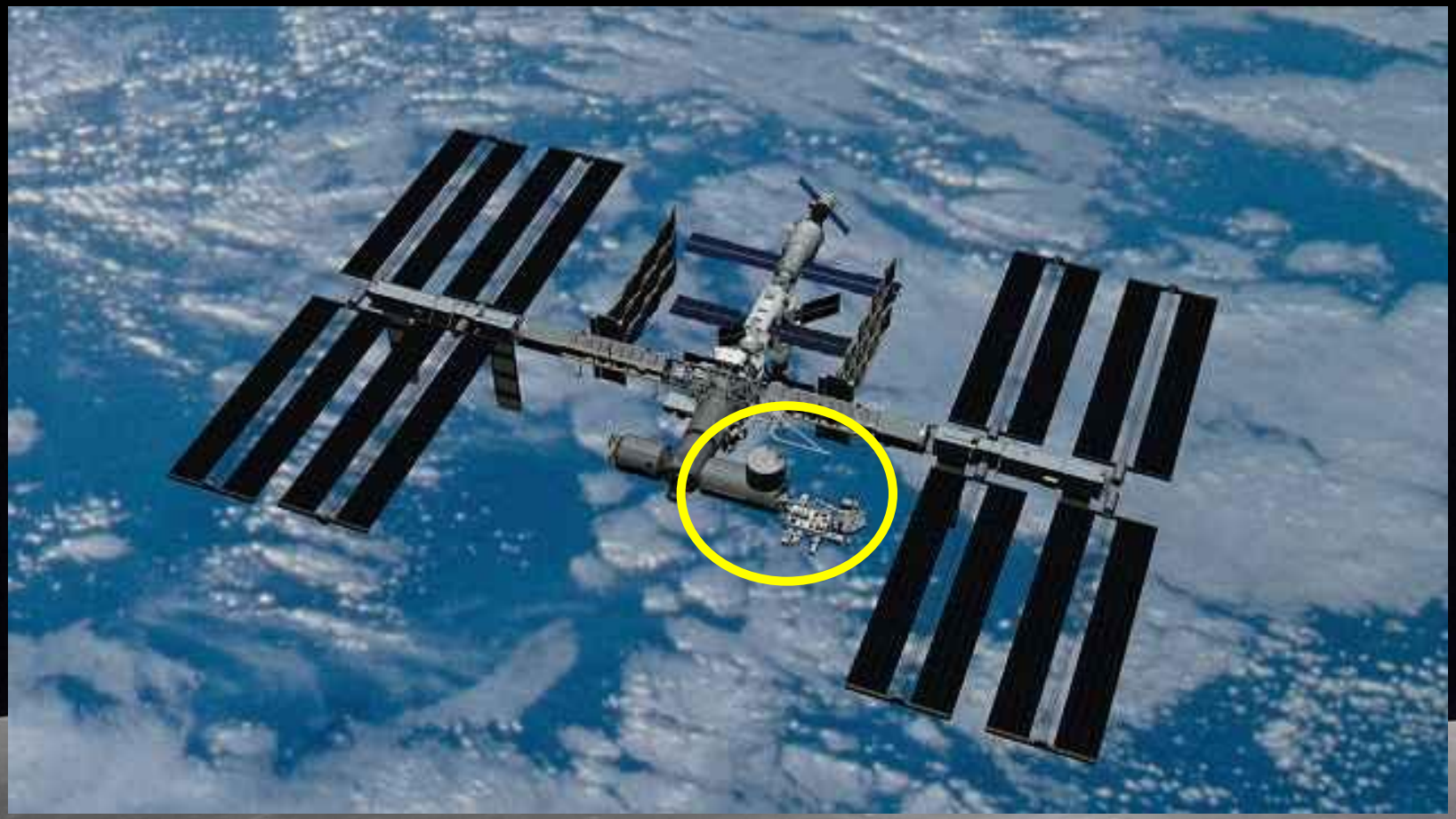


Total : $1.925B **$1= \100** **(Total : \192.5B)**

※ Budget was increased 2.6% from FY2008 (Total \187.5B)

ISS

KIBO/Japanese Experiment Module



- KIBO means “hope” in Japanese
- JAXA’s share of Utilization and Operation= 12.8% (in US Segment)

ISS

HTV (H-II Transfer Vehicle)

- Unmanned **cargo transfer spacecraft that will deliver up to 6 tons of supplies** to ISS
- **Key space transportation system technology** of Japan together with the H-IIB launch vehicle
- Successfully launched on Sep. 11, 2009 and disposed on Nov.1, 2009

HTV (Image)

HTV (Proto-flight model)
December 25, 2008

H-IIB Launch Vehicle

- JAXA and Mitsubishi Heavy Industries, LTD (MHI) are jointly developing H-ⅡB in order to launch HTV and to increase international competitiveness by providing wider range of launch capacity.
- H-IIB has 2 liquid rocket engines (LE-7A) in the first stage
- Its first stage body is expanded from 4m to 5.2m in diameter from H-IIA

Comparison of H-IIA and H-IIB

		H-IIA202	H-IIB
Specifications	Length (m)	53	56
	Mass (t)	289	551
	SRB-A	2	4
Maximum Launch Capacity (t)	GTO	4.1	8
	Orbit for HTV	-	16.5

ISS
HTV (H-II Transfer Vehicle)

◆HTV plays a significant role in ISS operation and utilization

HTV unique capabilities

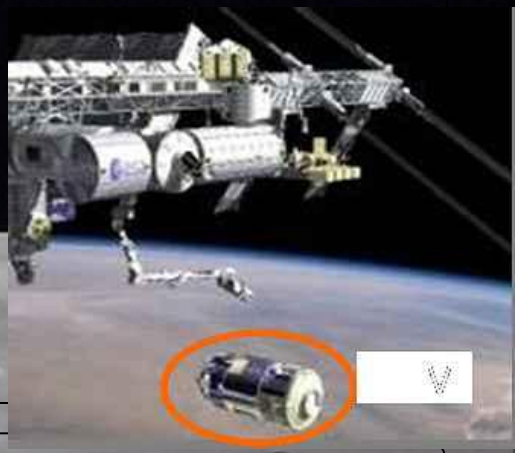
- HTV transports external equipments indispensable for sustaining ISS system functions such as attitude control (ISS gyro) and electrical power (batteries); external experiment payloads; large (standard rack size) internal system equipments and experiment payloads; water and food for astronauts.


ISS Gyro


Batteries


Internal Standard Racks

- After rendezvous flight to the ISS, HTV is docked to the ISS US-side port. The HTV pressurized section is the area where astronauts work for internal cargo transfer.



HTV launch schedule

One launch per year

Global Earth Observation System of Systems (GEOSS)

10 year Implementation Plan

9 Societal Benefit Areas

Disasters

Climate

Water

Health

Agriculture

Weather

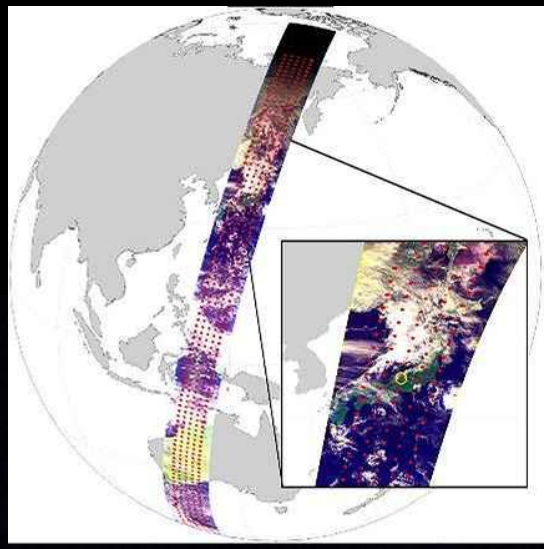
Ecosystems

Energy

Biodiversity

“IBUKI”GOSAT
Greenhouse gases observing satellite (GOSAT)

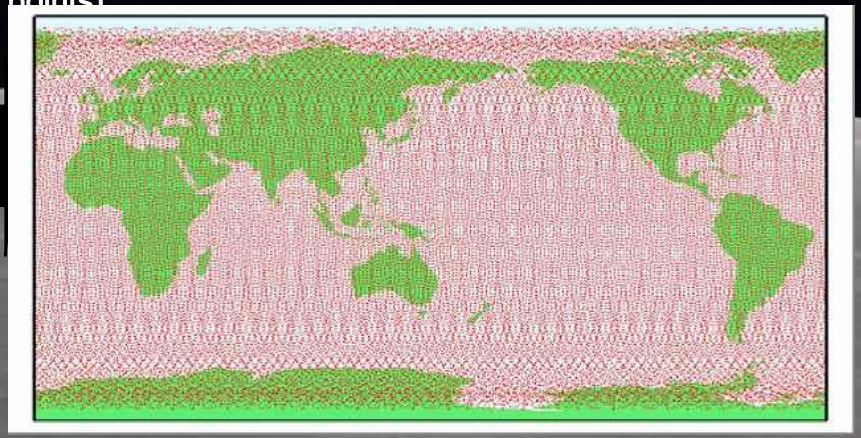
To monitor the distribution of the density of carbon dioxide, etc. and contribute to the activities for the prevention of global warming. Monitoring at 3-day intervals.
“IBUKI” was successfully launched on Jan.23, 2009 (JST) and is now carried out the initial calibration and validation operations including comparing IBUKI data and data acquired on the ground, confirming the data accuracy, and making compensations based on the data.



Successfully Deployed
The photo taken by FGAN, Germany

Current terrestrial observation points (257points)

GOSAT’s observation points (standard mode：56,000 points)



GPM
(Global Precipitation Measurement)

-NASA and JAXA are working together to build and launch the GPM Core Satellite
-The core is the central precipitation-measuring observatory of GPM
Dual-frequency Precipitation Radar (DPR)
a high-resolution, multi-channel passive microwave (PMW) rain radiometer known as the GPM Microwave Imager (GMI)
-The Core will also serve as the calibration reference system for a constellation of support satellites.

GCOM

To continue global-scale observations of sea water temperatures and soil water, etc. for the purpose of elucidating the global climate change and water circulation mechanisms.

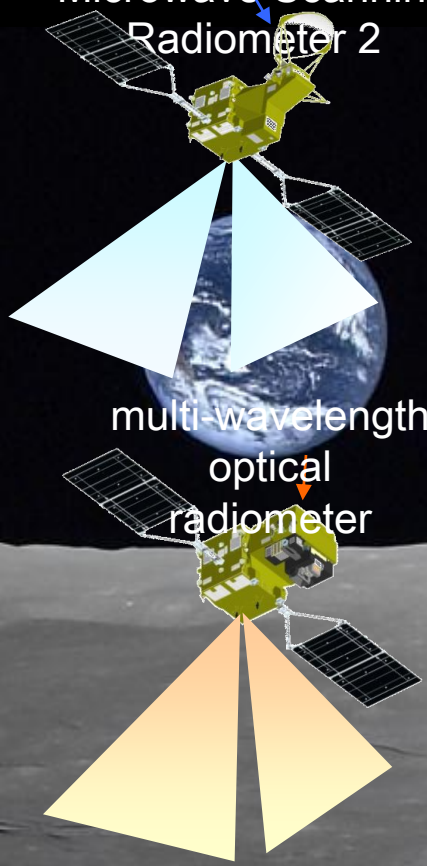
Global Change Observation Mission (GCOM)

Water cycle observation satellite (GCOM-W)

【scheduled to be launched in the period of the 2nd Mid-term Plan】

The Advanced Microwave Scanning Radiometer 2

- Precipitation
- Vapor amounts
- Sea surface temperatures
- Sea ice
- Soil water
- Snow depths



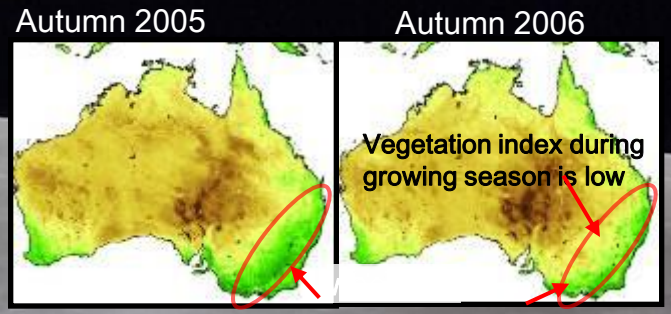
Climate change observation satellite (GCOM-C)

multi-wavelength optical radiometer

- vegetation
- Land surface temperature
- sea surface temperatures
- seawater color
- clouds, aerosol

Distribution of sea ice in north polar region

Monitoring of vegetation change



Crops yields of wheat was reduced by half in 2006 because of dry weather.

International Charter - Space and Major Disasters

- to provide a unified system of space data acquisition and delivery to those affected by natural disasters through Authorized Users
- to support the provisions of the Charter
- to help to mitigate the effects of disasters on human life and property

JAXA joined in February 2005

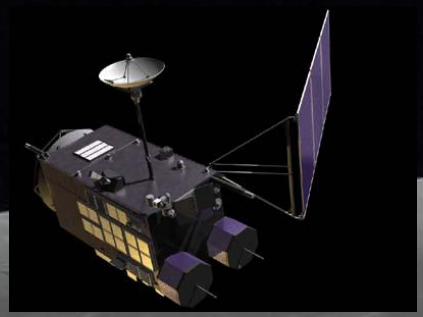
Space Science and Space Explorer

Ex)
-Fermi
-HINODE
-SWIFT
-NOZOMI
-ASCA
-ASTRO-H
-KAGUYA
-SUZAKU
-HAYABUSA
-HALCA
-GEOTAIL

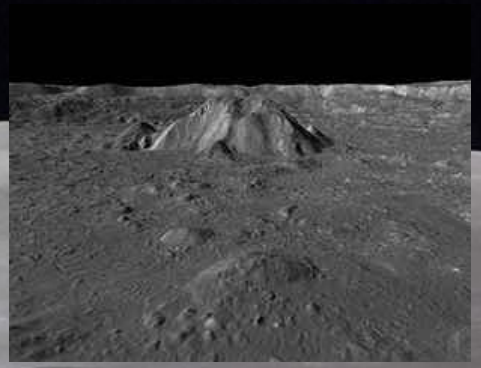
KAGUYA

- To obtain data and information necessary for elucidating the Moon's origin and its evolution as well as for exploring the possibility of utilizing the Moon in the future.
- To Acquire core technologies relating to the full-scale exploration of the Moon in the future.
- Launched Sep. 14, 2007, nominal operation during December 21, 2007 – October 30, 2008, extended operation till early summer, 2009.
- Collaboration with NASA for KAGUYA tracking for critical operation, KAGUYA data delivery for NASA LRO/LCROSS and future lunar mission planning, and KAGUYA data promotion and public outreach.

Lunar Explorer
「KAGUYA」



3D image
by Terrain Camera



KAGUYA has 15 missions and observes the Moon from a lunar polar orbit at the altitude of 100km.

HAYABUSA

Demonstration of the technology needed for sample return from asteroid, using electric propulsion, autonomous navigation, material sampling in small gravity field, and direct re-entry from interplanetary orbit.

Launch on May 2003
Touch-down and Lift-off from Asteroid on Nov. 2005
Earth return on Jun. 2010

JPL supports telemetry, command, tracking operation, and orbit determination in critical phases such as launch, earth swing-by, rendezvous with asteroid, and Earth reentry.

Asteroid Explorer
Hayabusa

Touch-down and Lift-off
from Asteroid surface

Roundtrip between Earth and Asteroid
Earth return on June 2010